A COMPARATIVE STUDY OF SELECTED AEROBIC AND ANAEROBIC PARAMETERS AMONG SPORTSPERSONS OF INDIVIDUAL SPORTS, TEAM SPORTS AND COMBAT SPORTS

SYNOPSIS FOR PRE-THESIS COLLOQUIM

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Chapter 1

Introduction

Introduction

In today's modern society individuals have come across more changes and disasters then of ancestors. Improvement in current technology has empowered our recent day society to live in a world where physical work is very less. We are continually searching for approaches to make life modest, in the sense of less physical work and energy.

In the process of making life simpler, living habits like increased laziness, physical inactivity and stationary nature are severe risk to the body, causing significant weakening in regular body functions. Normal and serious medical issues like obesity, depression, anxiety, and hypertension lower back problems and heart diseases etc. are directly and/or indirectly related to the amount of physical action one will do in daily routine

Intentionally or unintentionally life of humans becomes lazier and less dynamic by depending up on Modernization of technology, living style and automation system. Because of inactive way of life, numerous individuals' experience the illness related to physical fitness and inactivity or hypo-kinetic.

In these days most common and serious health issue amongst children and adults are obesity. Basically, obesity is excessive growth of fatty tissues. To defend most of the illness is to put bones, joints, heart, muscles, lungs, and various body parts to work on routine basis daily in a systematic manner.

Physical fitness is individual's richest possession. It cannot be neither borrowed nor given to anybody. It must be maintained through physical exercise in regular routine manner. It is witnessed that weak ones are country's liability whereas fit citizens are asset of the country.

Fitness is the fundamental requirement to carry out by an individual amongst many other tasks in routine life. There are multiple ways are there to improve health and physical fitness. Routine physical exercise includes slow continuous running, brisk walking, laughter exercises aerobic dances, callisthenic drills, yogasana, laughter exercises, and so on. Each of these has their own dos and don'ts. One can do any one or group of above with prior knowledge of exercise regulations.

Physical fitness

Hooks (1958) defines "physical fitness as the prime requisite to lead the optimum life and to live most and serve best. A sound mind and a sound body are man's most precious possession."

Bucher (1958) defines physical fitness as "the ability of an individual to live a full and balanced life. It involves physical, mental, emotional, social and spiritual factor and the capacity for their wholesome expression."

Fleshman (1964) refers to physical fitness as "functional capacity of an individual to perform certain kind of tasks requiring muscular activity."

Catchell (1965) explains "physical fitness as the capacity of the heart, blood vessels,

lungs and muscles to function at optimal efficiency."

Harrison H Clark et al (1989) defines as "Physical fitness is the ability to carry out daily task with vigor and alertness, without undue fatigue, and with ample energy to engage in leisure pursuit and to meet emergency situations."

S. M. Prakash (1994) defines "Physical fitness in its simplest form is the ability of an individual to perform any given tasks involving muscular effort in coordination with cardio- respiratory system."

The implication of the word physical fitness differs from person to person, more commonly it is defined as abilities of an individual to perform particular type of physical task. Physical fitness is not just muscle building but it also includes cardio respiratory fitness etc. Broadly basic elements of physical fitness are given below

- Strength
- Muscular
- Endurance
- Cardio-respiratory endurance
- Body composition and flexibility

There is extensive proof of the constructive outcome of sports and exercise on instructive results, including mental advantages and psychological advantages. Thus, sport and exercise have been appeared to effect various ultimate results, including instructive

accomplishment. There are a couple of differentiating considers which distinguish negative impacts of sports cooperation on the instructive accomplishment of explicit gatherings of understudies.

Training

Training infers involvement in a program of regular and dynamic physical activity with the main purpose of improving either health and/or physical performance through the development of some element of fitness such as muscle strength, body flexibility or cardio-vascular function. Physical activity is expressed as "biological movement formed by skeletal muscles that requires energy disbursement" and yields healthy benefits. A type of physical activity is exercise and is defined as "a planned, organized and monotonous physical movement performed to progress or sustain one or more components of physical fitness." Physical inactivity indicates a level of activity less than that required to maintain good health. The art of physical fitness mainly deals with athletes. The main aim in training is to change biological variations to improve performance in particular event. It involves obedience to cautiously planned and executed activities. Attention is focused on parameters such as type of training, speed, intensity, repetition of the activities, frequency and length of workouts, duration and appropriate competition.

Exercise

Physical exercises are intentional physical activities intended for attaining desired physiological variations to improve performance or physical fitness or performance. Physical exercises can be categorized in numerous ways and one of the categorizations is

according to its outcome on performance. This classification is measured as the most effective and scientific. Physical exercises also can be categorized based on the muscle group being exercised and the apparatus being used. Certain exercise gives instant and direct result on sports performance and certain other exercises give indirect and not instant result on performance. In physical education the exercises are categorized in a different way, for example aerobic, demonstration calisthenics, demonstration, aerobic etc.

Aerobic and anaerobic

Basically exercise is categorized into two kinds aerobic and anaerobic based on the nature and duration. Aerobic exercise involves a monotonous, low resistance action (Skipping, cycling, walking etc.) that that continues over a prolonged time (typically more than 10 minutes). Anaerobic exercise involves high resistance, usually these exercise is not monotonous in nature (weight lifting) and is of short duration (typically one to three minutes).

Aerobic exercise

Aerobic word is made up of Greek words, 'Aeros' means air and 'Bios' meaning life. Aerobic exercise is dynamic enough to improve the body's requirement for oxygen and therefore intake of air and by means of that breathing capacity increases. Aerobic exercise is performed with a speed that permits an acceptable supply of oxygen to reach the muscles as actions. Usually this kind of exercise can be performed more than twenty minutes without draining.

The American college of sports medicine (ACSM) defines aerobic exercise as any

activity that uses huge muscle groups, can be maintained continuously and is rhythmic in nature. As the name itself suggests, muscle groups activated by this kind of exercise depend on aerobic metabolism to extract energy in form of adenosine triphosphate (ATP) from amino acids, Carbohydrates and fatty acids. The criterion measure for aerobic capacity is the peak oxygen consumption (VO_2). Factors affecting the aerobic workout are

- Frequency
- Duration
- Intensity

Sports

Sports is an action including physical effort and ability in which an individual or group contends with another or others for amusement. Most commonly sports are classified as follows

Individual Sports

There are sure games, for example, golf, bowling, and tennis that, generally, are viewed as individual games, which are sports played alone without colleagues. Indeed, there are special cases, for example, the Ryder Cup in golf, in which two groups from either side of the Atlantic Ocean contend, however regularly the opposition is for an individual trophy.

Combat sports

It is a physical game between two individuals, who battle one another, bolstered by

specific methods and strategies to vanquish the enemy, who will include eccentric responses inside a protected field of activity. These games disciplines are administered by rules of direct and time to guarantee the physical uprightness of every contender. The procedures created by every rival during battle are strikes, hold and the utilization of weapons.

Team sports

A group activity incorporates any game which includes players cooperating towards a mutual goal. A group activity is a movement wherein a gathering of people, on a similar group, cooperate to achieve an extreme objective which is as a rule to win. This should be possible in various manners, for example, outscoring the rival group. Colleagues set objectives, decide, impart, oversee struggle, and take care of issues in a steady, believing environment so as to achieve their goals.

Statement of the problem

The study will be discussing the selected aerobic and anaerobic parameters among sportspersons of individual sports, team sports and combat sports.

Delimitations

1. The study is delimitated to compare the selected aerobic and anaerobic parameters among sportspersons of long distance, Football, Hockey, Judo and Wrestling.
2. The study is delimitated to the sportspersons located in Dakshina Kannada, Udupi and Kodagu districts.

Limitations

The limitations of the study are as follows

3. The study might be hindered by the lack of efforts put in by the sportspersons during the data collection.
4. Personal efforts and motivation of the participants may play a role in deciding the reliability of the results of the tests.

Hypothesis

Based on the literature review conducted and critically analyzing earlier results following hypotheses are formulated

Hypothesis 1:

There is significant difference in Speed between Individual sports group, Team sports group and Combat sports group.

Hypothesis 2:

There is significant difference in Maximal oxygen uptake (VO_2 Max) between Individual sports group, Team sports group and Combat sports group.

Hypothesis 3:

There is significant difference in Forced Vital Capacity between Individual sports group, Team sports group and Combat sports group.

Hypothesis 4:

There is significant difference in Recovery Heart Rate between Individual sports group, Team sports group and Combat sports group.

Hypothesis 5:

There is significant difference in Lactate Threshold between Individual sports group, Team sports group and Combat sports group.

Hypothesis 6:

There is significant difference in Muscular Endurance of Shoulder between Individual sports group, Team sports group and Combat sports group.

Hypothesis 7:

There is significant difference in Muscular Endurance of Abdomen muscles between Individual sports group, Team sports group and Combat sports group.

Significance of the study

1. The results can be used to compare the fitness levels of sportspersons of different games and thereby training can be modified to bring a change in the physiological parameters.
2. Through the specific energy requirements among difference sports are already established and published, this study will throw light on the variations is such physiological parameters at the district, university and state level.
3. The Coaches and the Physical Education Directors can be educated regarding the differences in demands of difference sports and thereby bring a positive change in

coaching methodology.

4. The results of the study can be used as a benchmark for forming new coaching policies and lead to better performance and results.
5. Research at the local level make people aware of the intricacies and the scientific processes that go into the making of an athlete and thereby educate the society about the importance and complexities of sports performance.

Definition of terms

Individual sports

An "Individual sports" is a sport in which participants compete as individuals. Examples of individual sports are boxing, MMA, wrestling, track, golf, tennis etc. (http://samples.jblearning.com).

Team sports

A "Team sports" is an activity in which group of individuals on the same team, work together to accomplish particular goal which is usually to win. Examples of team sports are Kabbadi, football, baseball, cricket, hockey etc. (https://caronefitness.com).

Combat sports

Combat sports may be defined as sports wherein two individual combatants fight each other using realistic fighting techniques according to pre-arranged rules. Two combatants fight against each other to gain enough points or a condition to declare a single winner by means

of using certain rules of direct younger engagement. Examples of combat sports are mixed martial arts, judo, fencing, savate, kickboxing, muay thai, sanda etc. (Regulation of combat sport in the ACT, December 2015).

Body weight

The weight of a person's body. The term body weight is overwhelmingly used in daily English speech as well as in the contexts of biological and medical sciences to describe the mass of an organism's body. Body weight is measured in kilograms throughout the world (Wikipedia, 2010).

Body mass index

Measure of the relationship between height and weight calculated by dividing the weight in kg by height in meters squared (King, T. C., & King, T. C., 2007).

Aerobic exercise

An aerobic exercise is defined as any activity that uses huge muscle groups, can be maintained continuously and is rhythmic in nature (Patel et al., 2017).

Maximal oxygen uptake (VO_2 Max)

Maximal oxygen uptake or as it is commonly called VO2 MAX, is the maximum amount of oxygen that your body consumes per minute during endurance exercise. VO2 Max is important for prolonged high/intensity intermittent exercise as it is an important of the ability to sustaining intensity exercise for longer than four to five minutes (McArdle et.al.,

2001).

Lactate threshold

Lactate Threshold refers to the highest exercise intensity that can be maintained with less than a1.0mmol L-1 increase in blood lactate above the pre-exercise level (McArdle et.al., 2001). This is exercise intensity is commonly thought to be the maximum than an individual can maintain for a prolonged duration of exercise.

Cardiovascular endurance

Cardiovascular endurance is the ability of the heart, lungs, and blood vessels to deliver oxygen to working muscles and tissues, as well as the ability of those muscles and tissues to utilize that oxygen (Matt, 2008).

Anaerobic exercise

Anaerobic exercise can be defined as intense physical activity of very short duration, fueled by the energy sources within the contracting muscles and independent of the use inhaled oxygen as energy source (Patel et al., 2017)

Anaerobic threshold (AT)

Anaerobic exercise constantly increases lactate and metabolic acidosis, and this transition point is called as anaerobic threshold (AT). AT can be measured by frequent blood samples measuring the blood lactate level during graded exercise routine (Ghosh, 2004).

Forced vital capacity (FVC)

Forced vital capacity is the amount of air that can be forcibly exhaled from your lungs after

taking the deepest breath possible (Moore, 2012).

Chapter 2

Review of Literature

Sincere efforts are made to locate literature associated with this research work. The relevant studies found from various sources, which the investigator has encountered, are enumerated below.

Gurjar et al. (2011), examined to find out about the impact of strength exercise on the pace and sprint launch. For this study, 20 male students were randomly picked as participants. The participants were between 18 and 21 years of age. All subjects were boarders and routine physical training courses, according to the Institute's planned programme. The topics were randomly split into two categories – a test group and a control group. Initial data were obtained within 50mts. run and 30mts. run after 21 familiarize the subjects with testing and training procedures. Data were obtained on the same things after 6 weeks of preparation. The importance of variations values has been checked with the aid of the paired "t" measure, with meaning levels at 0.05. Results reveal that the timing of 30mt. run after the testing decreased significantly, as the 't' value received was 2.26, which in nine degrees were important. No major variation has been noted in the case of the test group.

Gruber et al. (2014) led an examination to explore the impacts of IT on lung work power (P) and oxygen take-up (VO2) at top execution (top) and ventilatory anaerobic edge (VAT) in CF patients who couldn't take an interest in a standard exercise program (SEP) and to contrast these IT reactions and comparing impacts in CF patients performing SEP. 20 patients (FEV1 25.5 ± 7.5%; pred; SpO2 < 90% very still or P lower than 0.3 W/kg)

who couldn't take part in SEP were allotted to IT (5 × 20 min week after week). 23 patients (FEV1 31.6 ± 4.2%; $p < 0.05$) did 5 × 45 min for every seven day stretch of SEP. Lung work stayed unaltered in the two gatherings. VO2peak and PVAT expanded in the two gatherings ($p < 0.05$). Be that as it may, simply after the SEP an expansion in peak ($p < 0.05$) and simply after IT a higher VO2VAT ($p < 0.05$) were found. Contrasted with SEP, IT improved sub maximal exercise ability positively while responsiveness on top execution was higher in SEP. This appears to demonstrate a particular capability of IT for positive fringe strong adjustments regardless of decreasing capability of pneumonic improvement. It speaks to another option, viable and safe preparing routine with patients with CF and extreme lung infection, with a more prominent potential than SEP.

Opotowsky et al. (2014) expected to characterize the pervasiveness and physiological importance of pneumonic brokenness in patients with Fontan physiology. We broke down information from the Pediatric Heart Network Fontan Cross-Sectional Study to survey the pervasiveness and example of strange spirometry in Fontan patients (6-18 yr old) and researched the connection between low Forced Vital Capacity (FVC) and most extreme exercise factors, including top O2 utilization (Vo2peak), among the individuals who exhibited satisfactory exertion ($n = 260$). Normal ages at the hour of activity testing and Fontan consummation were 13.2 ± 3.0 and 3.5 ± 2.2 yr old, separately. Oxygen consuming limit was diminished (Vo2peak: 67.3 ± 15.6% anticipated). FVC found the middle value of 79.0 ± 14.8% anticipated, with 45.8% having a FVC not exactly the lower furthest reaches of typical. Just 7.8% exhibited obstructive spirometry. Patients with

low FVC had lower Vo2peak (64.4 ± 15.9% versus 69.7 ± 14.9% anticipated, P < 0.01); low FVC autonomously anticipated lower Vo2peak in the wake of changing for pertinent covariates. Among those with Vo2peak < 80% anticipated (n = 204/260), 22.5% exhibited an aspiratory mechanical commitment to practice constraint (breathing store < 20%). Those with both low FVC and ventilator wastefulness (minute ventilation/CO2 creation > 40) had notably diminished Vo2peak (61.5 ± 15.3% versus 72.0 ± 14.9% anticipated, P < 0.01) and a higher pervasiveness of pneumonic mechanical cutoff contrasted and patients with typical FVC and productive ventilation (36.1% versus 4.8%). All in all, anomalous FVC is basic in youthful patients after the Fontan technique and is freely connected with diminished exercise limit. A huge subset has a neurotically low breathing store, predictable with an aspiratory mechanical commitment to practice confinement.

Santana-Sosa et al. (2014) led an examination to evaluate the impacts of an 8-week consolidated 'entire muscle' (obstruction + vigorous) and inspiratory muscle preparing (IMT) on lung volume, inspiratory muscle quality (PImax), and cardiorespiratory wellness (VO2 top) (essential results), and dynamic muscle quality, body organization and personal satisfaction in pediatric outpatients with CF (cystic fibrosis, optional results). We additionally decided the impacts of a detraining period. Members were arbitrarily apportioned with a square on sexual orientation to a control (standard treatment) or intercession gathering (beginning n=10 (6 young men) in each gathering; age 10±1 and 11±1 years). The last gathering played out a consolidated program (IMT (2 meetings/day) and oxygen-consuming + quality activities (3 days/week, in-emergency clinic)) that was

trailed by a 4-week detraining period. All members were assessed at benchmark, post-preparing, and detraining. Adherence to the preparation program found the middle value of 97.5%±1.7%. There was a huge collaboration (group×time) impact for PImax, VO2peak, and five-redundancy most extreme quality (leg press, seat press, situated line) (all ($p<0.001$), and for %fat ($p<0.023$) and without %fat mass ($p=0.001$), with preparing to apply a noteworthy valuable impact just in the mediation gathering, which was kept up in the wake of detraining for PImax and leg-press. The moderately present moment (8-week) preparing program utilized here instigated critical advantages in significant wellbeing phenotypes of pediatric patients with CF. IMT is an effectively relevant mediation that could be incorporated, along with managed practice preparing in the standard consideration of these patients.

Zolaktaf et al. (2013) led an examination intended to contrast the impacts of bounce-back treatment with vigorous preparation in male asthmatic patients. The test included 37 male asthmatic patients (20-40 years) from the equivalent respiratory facility. In the wake of marking the educated assent, subjects elected to partake in charge, bounce back, or high-impact gatherings. There was no adjustment in the normal clinical treatment of patients. Regulated exercise programs proceeded for about two months, comprising of two meetings of 45 to an hour out of every week. Models measures were evaluated pre-and post-practice programs. Pinnacle practice limit (VO2peak) was assessed by adjusted Bruce convention, Forced essential limit (FVC), Forced expiratory volume in 1 second (FEV1), and FEV1% were estimated by the spirometer. Information was investigated by rehashed measure examination of fluctuation (ANOVA). Significant associations were watched for every one

of the 4 standards measures ($P < 0.01$), implying that both the activity programs were powerful in improving FVC, FEV1, FEV1%, and VO2peak. Bounce back exercise created a greater improvement in FEV1, FEV1%, and VO2peak. Regular practice reinforces the respiratory muscles and improves cell breath. Simultaneously, it improves the strength, respiratory, and cardiovascular frameworks. The impacts of bounce-back exercises appear to be encouraging. Discoveries propose that bounce-back exercise is a helpful integral method for asthmatic male patients.

Kim et al. (2012) led an examination to explore the impacts of a versatile chest band incorporated into inspiratory exercise for individuals with diminished chest work. Sixteen subjects with restricted rib portability were arbitrarily allocated to either test gathering (EG) or control gathering (CG), with eight subjects in each gathering. All subjects got an inspiratory exercise utilizing a motivating force spirometer for 30 minutes. For the subjects of the EG, a versatile chest band was joined into the inspiratory activities to give compressive protection from the chest. The chest work was estimated utilizing an electronic spirometer to decide the imperative limit (VC), flowing volume (TV), inspiratory hold volume (IRV), expiratory save volume, constrained crucial limit (FVC), constrained expiratory volume (FEV), FEV in 1-second (FEV) and the proportion of FEV to FVC (FEV %). Significant contrasts were found for the VC, TV, IRV, FVC, and FEV between pre-test and post-test in the two gatherings ($p<0.05$). Further, the adjustments in the estimations of VC (0.47 L versus 0.22L), FVC (0.55L versus 0.25L), and FEV1 (0.65% versus 0.21%) in the EG subjects were altogether more noteworthy than those in the CG subjects ($p<0.05$). These discoveries propose that a versatile chest band joined with

inspiratory exercise delivers extra constructive outcomes on improving chest work in individuals with constrained rib portability.

For the subjects of the EG, a flexible chest band was fused into the inspiratory activities to give compressive protection from the chest. The chest work was estimated utilizing an electronic spirometer to decide the crucial limit (VC), flowing volume (TV), inspiratory hold volume (IRV), expiratory save volume, constrained imperative limit (FVC), constrained expiratory volume (FEV), FEV in 1-second (FEV) and the proportion of FEV to FVC (FEV %). Significant contrasts were found for the VC, TV, IRV, FVC, and FEV between pre-test and post-test in the (0.65% versus 0.21%) in the EG subjects were essentially chest band joined with inspiratory exercise delivers extra beneficial outcome on improving chest work in individuals with restricted rib versatility. acquired every moment. There was no noteworthy distinction among UTM and LTM for VO2 very still or during any phase of activity aside from stage 3. Besides, there were no huge contrasts among UTM and LTM for HR, Ve, Bf, and RPE on any activity stage. Straight relapse of HR versus VO2, over all phases of activity, shows a comparative relationship in these factors during UTM ($r = .94$, $y = .269x - 10.86$) and LTM ($r = .95$, $y = .291x - 12.98$). This information demonstrates that UTM and LTM practice evokes comparable cardiorespiratory reactions and that HR can be utilized to manage suitable exercise power for school competitors during UTM.

Kemps et al. (2010) led to concentrate on the Assessment of the impacts of physical preparation in patients with the interminable cardiovascular breakdown: the utility of

exertion-free exercise factors. Generally, the impacts of physical preparation in patients with an interminable cardiovascular breakdown (CHF) were assessed by changes in top oxygen take-up (top VO (2)). The evaluation of pinnacle VO (2), be that as it may, was exceptionally reliant on the patients' inspiration. The point of the current investigation was to assess the clinical utility of exertion autonomous exercise factors for identifying preparing impacts in CHF patients. In a forthcoming controlled preliminary, patients with stable CHF were distributed to an intercession gathering (N = 30), playing out a 12-week joined cycle stretch and muscle obstruction preparing program, or a benchmark group (N = 18) that was coordinated for age, sex, body piece and left ventricular discharge part. The accompanying exertion autonomous exercise factors were assessed: the ventilatory anaerobic limit (VAT), oxygen take-up productivity slant (OUES), the V (E)/VCO (2) incline and the time steady of VO (2) energy during recuperation from submaximal consistent burden work out (tau-rec). Notwithstanding post-preparing increments in top VO (2) and pinnacle V (E), the intercession bunch demonstrated critical inside and between-bunch upgrades in VAT, OUES and tau-rec. There were no noteworthy contrasts between relative enhancements of the exertion free exercise factors in the mediation gathering. Conversely with VAT, which couldn't be resolved in 9% of the patients, OUES and tau-rec were resolved effectively in all patients. Thusly, we inferred that OUES and tau-rec were helpful in clinical practice for the appraisal of preparing impacts in CHF patients, particularly in instances of helpless subject exertion during indication constrained exercise testing or when patients couldn't arrive at a maximal exercise level.

Azevedo et al. (2018) conducted an experimental study to compare and also to know the relation between aerobic threshold (THaer), and anaerobic threshold (THanaer) measured during a new single judo-specific incremental test and tread mill test for aerobic demand study. Eight well trained male judo athletes (24.3 ± 7.9 years; height of 169.3 ± 6.7 cm; the fat mass of 12.7 ± 3.9%) participated voluntarily in this study. All the eight selected subjects were allowed to perform a specific incremental test mimicking the Uchi-komi using a cable crossover machine and also a running treadmill test until exhaustion. The tests were conducted at the same period of the day with a variation of 2 h and the interval between tests was 1 week. The purpose of this study is to; a) compare the similarity between aerobic and non-aerobic threshold b) to compare the intensities of the threshold between specific and general tests. Finally, the experimental result says that there is a poor relation between aerobic and non-aerobic thresholds and also between intensities.

Chapter 3

Methodology

The methodological aspects related to the present investigation have been described in this chapter. The procedure and methods applied in selection of subjects, selection of variables, selection of tests, orientation of testers and subjects, reliability of data, administration of tests, collection of the data, and experimental design and statistical techniques are described in detail.

Selection of subjects

120 boys (40 each) for long distance runners, Football/Hockey players and Wrestling/Judo athletes were enrolled in the study. The tests were conducted in season phase of competition and had no history of recent infection, asthma or cardio respiratory disorders. The athletic subjects were selected according to the exclusion criteria defined as follows: Subjects not having a good health at the moment of test, subjects who are non-confirmed and who did not have a regular presence in their training sessions or having been engaged for less than 3 years. On the basis of these criteria 32 subjects from 152 were excluded. Finally, 120 athletes were included in subsequent analysis. Control subjects were randomly recruited from sports promoted colleges of Dakshina Kannada and Udupi districts were engaged in minimum of two hours of physical activity in a day (Sunday excluded) at college. The long-distance runners and Football players were engaged in their sports training in both morning and in the evening sessions was held at on outdoors on a

synthetic/turf surface.

The training of the Footballers was mainly based on the technique aspect, agility, balance, coordination, and speed exercise and in Judo, the training was indoors and well-equipped hall and focused on the technique aspect, physical coordination, flexibility, body control, balance and fast reflexive action.

Selection of Variables

The present study was undertaken primarily to examine the status of concurrent aerobic and anaerobic parameters and selected physical fitness components. The researcher had gone through the available literature and had discussions with various experts and with his guide before selecting variables. The availability of technique for the purpose of analysis, feasibility, reliability of the procedure and the outcome were extensively taken care before finalizing the variables. The selected independent and dependent variables of this study are as follows.

Variables

Variables are the scenario that is observed, measured and is expected to be affected on or other means by altering the independent variables (Morehouse, 1975). For this study the following parameters were considered as variables:

- Maximum speed
- Maximal Aerobic Capacity
- Arm-shoulder strength endurance

- Abdominal strength endurance
- Forced Vital Capacity
- Recovery Heart Rate

Selection of Tests

The present study mainly focuses on effect of aerobic and anaerobic activities on individuals, group and combat sport personalities. The investigator analyzed various literature, has consulted with the experts in the field of physical education and adopted standardized testing procedures to collect data on selected physical fitness components, as given below

Sl. No.	Parameters	Tests	Units of measurement
1	Speed	Sprint test	meters
2	VO_2 max	Beep test	Number of levels converted to ml/Kg/min
3	Forced Vital Capacity	Spirometry	millimeters
4	Recovery Heart Rate	3 minutes after maximal exercise	Percentage of Maximal heart rate
5	Lactate Threshold	Conconi test	Percentage of Maximal heart rate
6	Strength endurance (Arm shoulder, Abdominal)	Push-ups, Bent knee sit-ups	Numbers of repetitions

Orientation to the Participants

Before the commencement of the tests, the investigator explained the purpose of

programme to the subjects and their part in the study. For the collection of the data, the investigator explained the procedure of testing of selected dependent variables and gave instructions about the procedure to be adopted by them for measuring. The subjects were sufficiently motivated to perform their maximal level during the testing period. All the participants who volunteered were well informed of the importance of the study.

Reliability of the Subjects

The subject reliability was established by test-retest method, all subjects were selected from Nitte campus, Alva's education foundation, and other institutes in Dakshin Kannada district, Karnataka, India and they were tested twice by the same tester under the similar conditions on each criterion variable so as to minimize error as much as possible.

Competence of the Tester

The investigator collected the data with the assistance of physical education department co-workers from NMAMIT Nitte, Udupi district, Karnataka. The purpose of the study and testing procedures were explained and demonstrated to the testers. The investigator had a number of practice sessions in order to familiarize the correct testing procedure.

Reliability of the Instrument

The required instruments availed from the NMAMIT, Nitte campus, Nitte Education Trust, Nitte and Department of PG Studies and Research in Physical Education, Mangalore University. They were in good working condition. The instruments were

purchased from the reliable and standardized companies. Their calibrations were tested and considered accurate enough to serve the purpose of the study.

Administration of the Tests

1. Sixty meters speed test

Sprint and speed tests can be performed over varying distances, depending on the factors being tested and the relevance to the sports.

Purpose: The purpose of the test is to measure the maximum sprint speed.

Equipment: An area on track for sixty meters course with a starting line, a finish line at sixty meters, stop watches and assistants.

Procedure: This test requires the subject to sprint as fast as possible over 60 meters and the procedure is as follows-.

- The athlete warms up for 10 minutes
- The assistant marks out a 60 meters. straight section on the tack with cones.
- The assistant gives the command "Go" and starts the stopwatch.
- The subjects sprint as fast as possible over the 60 meters.
- The assistant stops the stopwatch as the athlete's torso crosses the finishing line and recorded time to assess the athlete's performance.

Scoring: The score is the difference in elapsed time to the nearest 1/100th of a second between the times taken to cross the 60 meter point finish line. The best timing of the two trails was recorded as score.

2. Beep test

Purpose: To test the ability of the cardio-respiratory system to supply the exercising muscles with oxygen to maintain the aerobic exercise for a long period of time.

Equipment: 20 meters measuring tape, Flat & non-slip surface, marking cones, beep test audio, music player, recording sheets.

Procedure: This test requires subject to run continuously between two lines of 20 meters apart in time to recorded beeps and the procedure is as follows-

- The subject should stand behind one of the line facing second line.
- The subject begin running on getting instruction "GO" from instructor.
- The subject should run continuously between two lines, turning when indicated by recorded beeps.
- After one round indications will be given to increase speed consecutively and beeps will be closer together.
- If the line reached before the beep sound, the subject must wait for beep sound to continue running.
- If the line is not reached before the beep sound, a warning is given to subject and must continue to run to the line and turn and try to maintain the pace within two more beeps.
- The test is stopped if the subject fails to reach line (within 2 meters) for two consecutive ends after a warning.

Scoring: The subject score is the level and number of shuttles (20m) reached before they were unable to keep up with the recording. Record the last level completed and heart rate in terms of bpm.

VO_2 max can be calculated using numerical expression given by by Flouris et al. (2005)

$$VO_2 \text{ Max} = (\text{Maximal Aerobic Speed} \times 6.65 - 35.8) \times 0.95 + 0.182$$

3. Forced Vital Capacity

Purpose: To measure the air flow in and out of the lungs to determine forced vital capacity (FVC) and forced expiratory volume in one second (FEV1).

Equipment: Spirometer, score sheet.

Preparations: Prior to performing spirometer the subject was explained some of the don'ts well in advance of 3-4 days Such as wear tight clothing's, smoking, consumption of alcohol, and having heavy meal. All such activities effects inhale and exhaling of air.

Procedure: This test generally completes within 15 minutes using spirometer

- The subject is instructed to take proper position so that test can be conducted smoothly.
- Instructor / medical officer gives instruction to the subject about spirometer working and usage in determining vital capacity.
- After couple of normal breath, subject were asked to take deep breath and exhale in the spirometer forcefully as possible as much.
- FVC and FEV1 readings are recorded from spirometer.
- Three trials are taken with a rest of two minutes in each trial and best readings are taken.

Scoring: The best attempt of FVC and FEV1 readings are analyzed further to understand inhale and exhale of lungs.

4. Resting and Recovery Pulse Rate

Purpose: This test is to measure rate of the pulse beat per minute.

Equipment: Stop watch, stethoscope, score sheet.

Preparation: This test is conducted by ensuring the subject is relaxed physically and emotionally.

Procedure:

- Turn the palm of the hand so that it is facing up.
- To measure a pulse (Pulse can be felt where an artery close to the skin such as wrist, neck region or top of the foot), place index and middle fingers on the wrist about 2.5cm below the base of the hand.
- Count the number of beats for 60 seconds, this will give the heart rate for minute.

To calculate recovery heart rate

- The subject should take their pulsing rate soon after finishing exercise and record it.
- After one minute again take pulse rate and is subtracted from previous pulse rate so as to get recovery heart rate.

Scoring: There were 3 such repetitions of one-minute counts are performed and highest number is recorded for resting pulse rate.

5. Conconi Test (Lactate Threshold)

Purpose: To determine the heart rate at the anaerobic threshold for setting training zones.

Equipment: Stopwatch, heart rate monitor (with recording and recall function), running track or exercise equipment.

Preparation: Warm up consists of exercises of rising intensity lasting 5 to 10 minutes, which

are intended to prepare for the subsequent athletic events and to maximize results.

Procedure:

- The assistant sets the treadmill speed to an easy pace starting from 7 kmph.
- At the pre-determined intervals increase the speed of 0.5 kmph.
- Record the heart rate at the end of each speed levels.
- Continue the procedure until subject is exhaustion.

Scoring: Plot the heart rate over speed/workload as a graph. Connect the points with a line. Initially the heart rate and workload graph should be linear. At a high intensity, the point where the line bends corresponds to your anaerobic threshold. Record your heart rate and workload at this point on the graph.

Accuracy: This test assumes that the anaerobic threshold is related to a deflection point on the heart rate/intensity graph.

6. Push ups

Purpose: To assess the muscular endurance of the upper body muscle groups.

Equipment: Floor mat or flat ground, stopwatch.

Procedure: This test is to perform as many push-ups as one can be performed in one minute.

- The starting position is with the arms straight, elbows locked, body straight, hands placed slightly wider than shoulder-width apart with fingers pointing forward and both feet on the floor.

- From the starting position, on the command ‘go,’ the subject’s has to start the push-up by
- Bending their elbows and lowering their body until the shoulders drop below the level of the elbows, then return to the starting position.
- Pausing to rest is permitted only in the up (*starting*) position.

  Scoring: The maximum number of correctly performed push-ups in one minute is recorded.

7. Sit Ups

Purpose: To measure abdominal muscular endurance.

Equipment: Tumbling mat, stop watch.

Procedure:

- The starting position was a supine position with knees flexed to less than 90 degrees, feet on the mat, and 12 inches from the buttocks.
- Arms remained clasped behind the neck throughout the test. A partner held the feet in contact with the ground throughout the test.
- To begin the test the subjects’ curled up touching the thigh with chest and goes back. This sequence is continued for a minute.

Scoring: The score is the maximum number of sit-ups completed in one minute.

Statistical Technique

SPSS software was used to analyse the data. For the purpose of analysis, descriptive

statistics was used to present the test statistics and demographic data. ANOVA was applied to compute the significance of difference in performance in various parameters between the three groups. This was followed by applying the Tukeys Post Hoc test to find the significant difference between each of the groups.

Chapter 4

Presentation and Analysis of Data

This chapter discusses the data analysis and the findings of the study. The focus of this study was primarily to understand the comparative efficacy of the individual, the team and the combat sports players compared in anaerobic and aerobic performance variables. In this investigation 40 (n = 40) players of each sports Group1-Individual Sports Group (ISG), Group 2- Team Sports Group (TSG) and Group 3-Combat Sports Group (CSG), total of 120 (n = 120) sports personalities are included from different institutions in Dakshina kannada and Udupi district of Karnataka, India. The players who have participated in inter collegiate, university level, and national level are selected for this research. All subjects performed the selected tests of motor fitness such as speed, muscular strength (shoulder strength and abdominal strength) and physiological parameters such as vital capacity, recovery heart rate, VO2 max, and lactate threshold correspondingly. The dependent variables of this research is speed, muscular strength, vital capacity, heart rate recovery, maximal oxygen consumption (VO_2 max) and lactate threshold.

A brainstorming session for all the participants was conducted wherein they were explained in detail about the preparation and procedure of tests for motor fitness and physiological tests. The data recorded after the experimental period is statistically analyzed with the correlation, regression, and, analysis of variance (ANOVA). To perform ANOVA on obtained results, confidence level and significance level are defined as 95% and 5%

respectively. Whenever the significance level was found to be significant, post hoc tests are applied further to understand the paired mean differences. To find closest possible paired mean differences the Tukey post hoc test is used for motor fitness and physiological parameters.

Demographic data

Table 1 indicates the demographic data of the subjects. Predictably the individual athletes are less in height and weight resulting in lower BMI while those from combat group have a greater BMI. The team sportspersons lie in between. Overall the age of the sportspersons are similar and BMI differ as per the differences in their sport. This would indicate that the data that would be collected from various tests would reflect the influence of these factors.

Table 1.

Demographic data of subjects.

Groups	Age	Height (Cms.)	Weight (Kgs.)	BMI
Individual Sports Group (ISG)	20.85±1.72	166.5±7.2	57.48±6.5	20.76±2.1
Teams Sports Group (TSG)	21.03±2.11	170.7±5.8	65.21±7.0	22.42±2.6
Combat Sports Group (CSG)	21.28±2.15	171.2±7.3	75.78±13.5	25.82±3.9

Testing of Hypothesis

On the basis of the analysis and discussion the hypothesis testing is displayed in

Table 2.

Hypothesis testing details of all the Variables

Parameter tested	Hypothesis		H_0 acceptance or rejection
Speed	**H_0**	There is no significant difference in Speed between ISG, TSG and CSG	The H_0 is rejected for ISG and TSG.
	H_1	There is significant difference in Speed between ISG, TSG and CSG	The H_0 is rejected for ISG and CSG. The H_0 is accepted for TSG and CSG.
VO_2 Max	**H_0**	There is no significant difference in VO_2 Max between ISG, TSG and CSG	The H_0 is rejected for ISG and TSG. The H_0 is rejected for ISG and CSG.
	H_1	There is significant difference in VO_2 Max between ISG, TSG and CSG	The H_0 is accepted for TSG and CSG.
Forced Vital Capacity	**H_0**	There is no significant difference in forced vital capacity between ISG, TSG and CSG	The H_0 is rejected for ISG and TSG. The H_0 is rejected for ISG and CSG.
	H_1	There is significant difference in forced vital capacity between ISG, TSG and CSG	The H_0 is rejected for TSG and CSG.
Recovery Heart Rate	**H_0**	There is no significant difference in recovery heart rate between ISG, TSG and CSG	The H_0 is accepted for ISG and TSG. The H_0 is accepted for ISG and CSG.
	H_1	There is significant difference in recovery heart rate between ISG, TSG and CSG	The H_0 is accepted for TSG and CSG.

Table 3.
Hypothesis testing details of all the Variables (Contd.)

Parameter tested	Hypothesis		H_0 acceptance or rejection
Lactate Threshold	**H_0**	There is no significant difference in lactate threshold between ISG, TSG and CSG	The H_0 is rejected for ISG and TSG. The H_0 is accepted for ISG and CSG.
	H_1	There is significant difference in lactate threshold between ISG, TSG and CSG	The H_0 is accepted for TSG and CSG.
Shoulder Muscular Endurance	**H_0**	There is no significant difference in Shoulder muscular endurance between ISG, TSG and CSG	The H_0 is rejected for ISG and TSG. The H_0 is rejected for ISG and CSG.
	H_1	There is significant difference Shoulder muscular endurance in between ISG, TSG and CSG	The H_0 is rejected for TSG and CSG.
Abdominal Muscular Endurance	**H_0**	There is no significant difference in Abdominal muscular endurance between ISG, TSG and CSG.	The H_0 is rejected for ISG and TSG. The H_0 is rejected for ISG and CSG.
	H_1	There is significant difference in Abdominal muscular endurance between ISG, TSG and CSG	The H_0 is rejected for TSG and CSG.

The summary of this chapter is illustrated in table 4.

Table 4.
Comparative significance between the motor fitness and physiological parameters of different groups.

Parameters	Mean (Groups I, II and III)	Group Pair	p-value	Sig.	Observation
	8.46	I vs II	$p<0.01$	yes	

Sixty meters speed	8.84 8.97	I vs III II vs III	p<0.01 p>0.05	yes no	Individual sports personality's finishes test in minimal time followed by team and combat.
VO_2 max	57.13 52.45 49.61	I vs II I vs III II vs III	p<0.01 p<0.01 p<0.01	yes yes yes	The sport personality belonging to the individual sports has maximum aerobic endurance compared to the team and combat players.
Vital capacity	3.19 3.48 3.96	I vs II I vs III II vs III	p>0.05 p<0.01 p<0.01	No Yes Yes	The sport personality belongs to the individual sports has minimum lung capacity compared to the team and combat players.
Recovery heart rate	38.89 40.31 40.19	I vs II I vs III II vs III	p>0.05 p>0.05 p>0.05	No No No	All sports participants have little more or less same heart rate recovery.
Lactate threshold	90.67 92.45 91.25	I vs II I vs III II vs III	P<0.05 p>0.05 p>0.05	Yes No No	The lactate threshold has almost equal in team and combat sport personalities and less in individual sports personalities.
Shoulder strength	49.3 51.1 52.73	I vs II I vs III II vs III	p<0.01 p<0.01 p<0.01	Yes Yes Yes	The combat sports participants have more shoulder muscular strength than the individual and team sports personalities.
Abdominal strength	41.15 46.13 49.65	I vs II I vs III II vs III	p<0.01 p<0.01 p<0.01	Yes Yes Yes	The combat sports participants have more abdominal muscular strength than the individual and team sports personalities.

*I-ISG, II-TSG, III-CSG.

Based on the experimental observation and result analysis it can be noted that,

- Individual sports participant's shows better performance in in sixty-meter speed test, maximum oxygen uptake followed by team sports when compared to the combat sports.

- Combat and team sports participants have better vital capacity than the individual sports.
- There is no significant difference between the three groups in association with the heart rate recovery.
- Combat and team sports persons have better lactate threshold compared to the individual sport participants.
- The combat sport personalities have enhanced muscular strength followed by team and individual sports.

Chapter 5

Conclusion and Recommendations

Conclusions

Within the limits identified and on the basis of findings obtained by data analysis, the following conclusions were drawn:

- Individual sports participants show better performance in maximum oxygen uptake followed by team sports when compared to combat sports. The individual sports persons comprise of track and field endurance athletes and therefore it can be safely concluded that they would have better oxygen uptake. But the TSG and CSG do not vary significantly.
- Surprisingly CSG and TSG sportspersons have a better lactate threshold compared to the ISG. The TSG has significantly more lactate threshold from ISG, it does not vary significantly from CSG nor does CSG vary significantly from ISG. This could be because the individual athletes are mostly aerobic runners.
- There is no significant difference between the three groups in association with the heart rate recovery.
- The sports personality belonging to individual sports has maximum strength in sixty-meter speed test to compared to the team and combat players.
- The combat sports personalities exhibited more muscular strength compared to the team and individual sports

Recommendations

- This study throws light on the important physiological profiles of collegiate athletes. It should be noted that collegiate athletes are not professional athletes and therefore their values would vary on the amount of practice and commitment that they share to achieve excellence. So, from this perspective, this study could be further progressed to compare the results with the elite counterparts of these groups.
- A similar study may be attempted by selecting the elite sports persons as subjects.
- The selection of women sportsmen as participants might be tried to make comparable research.
- This study may be further extended to the other age group participants.
- A depth analysis on lactate threshold with different approaches can be undertaken.

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